ABSTRACT OF THE DISCLOSURE

A high power high yield target for the positron emission tomography applications is introduced. For production of Curie level of Fluorine-18 isotope from a beam of proton it uses about one tenth of Oxygen-18 water compared to a conventional water target. The target is also configured to be used for production of all other radioisotopes that are used for positron emission tomography. When the target functions as a water target the material sample being oxygen-18 water or oxygen-16 water is heated to steam prior to irradiation using heating elements that are housed in the target body. The material sample is kept in steam phase during the irradiation and cooled to liquid phase after irradiation. To keep the material sample in steam phase a microprocessor monitoring the target temperature manipulates the flow of coolant in the cooling section that is attached to the target and the status of the heaters and air blowers mounted adjacent to the target. When the target functions as a gas target the generated heat from the beam is removed from the target by air blowers and the cooling section. The rupture point of the target window is increased by a factor of two or higher by one thin wire or two parallel thin wires welded at the end of a small hollow tube which is held against the target window. One or two coils are used to produce a magnetic filed along the beam path for preventing the density depression along the beam path and suppression of other instabilities that can develop in a high power target.